Application of the Convex Hyperbola Charts to minimise the energy consumption of a pumping station in a real case in Spain

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This study aims to put in practice the theory of the Convex Hyperbola Charts in a real case study. The Convex Hyperbola Charts can be used to determine how many hydraulic pumps must be running to provide the desired volume of water using the least possible energy. This is typically done with complex iterative algorithms that require great computational efforts. The proposed method however analyses the task from an analytical perspective, and the result are a series of curves that are easy to elaborate and of instantaneous use: they are the curves of Hyperbolic Convexity. This research is carried out to prove the immediate applicability and simplicity of the Convex Hyperbola Charts, however intimidating the name of the method may seem. These charts immediately indicate, based on the desired volume of water, which is the best combination of pumps to minimize energy consumption. A real case in Spain is analyzed. The case consists of a water drive from a peripheral city to the water supply network of Madrid: The water is provided from a reservoir and it is then pumped by a collection of up-to eight parallel hydraulic pumps. The water flows through a pipe consisting on different materials, to finally arrive to a small deposit that connects with the network of the capital. The Convex Hyperbola Charts were elaborated and showed the optimum number of pumps that should be working for any desired volume of water. The research shows the energy and cost savings that could be obtained by the utilization of the Convex Hyperbola Charts.